

Vol 35, No 3
July 2011

Chronic periodontitis and fetal birth weight 105

Research Report

Correlations of Chronic Periodontitis with Preeclampsia and Fetal Birth Weight

Korelasi antara Kejadian Periodontitis Kronis dengan Preeklampsia dan Berat Badan Lahir Bayi

Octaviana Yoseffin, Gusriani, Johannes C. Mose

Department of Obstetrics and Gynecology
Medical Faculty of Padjadjaran University/
Dr. Hasan Sadikin General Hospital
Bandung

Abstract

Objective: Preeclampsia is the main cause of maternal and perinatal mortality and morbidity one of which low birth weight. The cause of preeclampsia is multifactorial, and one of them is infection. High periodontal incidence is found in preeclampsia patients. This study is intended to find correlations between chronic periodontitis with preeclampsia and fetal birth weight.

Method: The study was held in RS Dr. Hasan Sadikin Bandung, RSUD Astana Anyar and RSUD Ujung Berung in December 2010 - February 2011 using case-control study design in two groups, with 26 subjects in each group. The subjects were recorded on age, parity, gestational age, diagnosis, fetal birth weight, and periodontal status. Statistical analysis were performed using chi square test and Rank Spearman's correlation test.

Result: The characteristics of study subjects in both groups show no significant difference ($p > 0.05$). In the preeclampsia group, periodontitis incidence is higher which is 19 (73.08%) compared to control group which is 12 (46.15%). Based on chi square method, there is a significant correlation between periodontitis and preeclampsia with odds ratio value of 3.17 ($p = 0.048$; $p < 0.05$; 95%CI (1.19 - 8.41)). Based on Rank-Spearman correlation test, there is a moderate negative correlation between periodontitis severity and with fetal birth weight with rs value of -0.423 and a p value of 0.002.

Conclusion: Chronic periodontitis incidence is higher in preeclampsia group compared to control group. There's a moderate negative correlation on periodontitis severity with fetal birth weight. The more severe the periodontitis, the lower the fetal birth weight.

[Indones J Obstet Gynecol 2011; 35-3: 105-9]

Keywords: periodontitis, preeclampsia, fetal birth weight

Abstrak

Tujuan: Preeklampsia merupakan penyebab utama mortalitas dan morbiditas perinatal, salah satu di antaranya yaitu bayi berat lahir rendah. Penyebab preeklampsia multifaktorial, faktor infeksi merupakan salah satu penyebabnya. Kejadian periodontitis banyak ditemukan pada pasien preeklampsia. Penelitian ini bertujuan mengetahui korelasi antara kejadian periodontitis kronis dengan preeklampsia dan berat badan lahir bayi.

Metode: Penelitian dilakukan di RS Dr. Hasan Sadikin Bandung, RSUD Astana Anyar dan RSUD Ujung Berung dari bulan Desember 2010 - Februari 2011 dengan rancangan penelitian studi kasus-kontrol pada dua kelompok penelitian dengan jumlah masing-masing kelompok 26 subjek penelitian. Pada subjek dicatat umur, paritas, usia kehamilan, diagnosis, berat badan lahir bayi, dan status periodontitis. Terhadap data penelitian dilakukan analisis statistik dengan menggunakan uji chi kuadrat dan uji korelasi Rank-Spearman.

Hasil: Karakteristik subjek penelitian pada kedua kelompok tidak terdapat perbedaan yang bermakna ($p > 0,05$). Pada kelompok preeklampsia kejadian periodontitis kronis lebih tinggi yaitu 19 (73,08%) dibandingkan dengan kelompok kontrol 12 (46,15%). Berdasarkan uji chi kuadrat diperoleh hubungan yang bermakna antara periodontitis kronis dengan preeklampsia dengan nilai rasio odds 3,17 ($p = 0,048$; $p < 0,05$; 95%CI (1,19 - 8,41) dan periodontitis berat memiliki risiko 16 kali untuk terjadinya preeklampsia. Berdasarkan uji korelasi Rank-Spearman diperoleh korelasi negatif sedang antara derajat periodontitis dengan berat badan lahir bayi dengan nilai $rs = -0,423$ dan nilai $p = 0,002$.

Kesimpulan: Kejadian periodontitis kronis lebih banyak ditemukan pada preeklampsia dibandingkan tanpa preeklampsia. Terdapat korelasi yang negatif sedang pada derajat keparahan periodontitis dengan berat badan lahir bayi. Semakin berat derajat periodontitis, maka semakin rendah berat badan lahir bayi.

[Maj Obstet Ginekol Indones 2011; 35-3: 105-9]

Kata kunci: periodontitis, preeklampsia, berat badan lahir bayi

Correspondence: Octaviana Yoseffin. Department of Obstetrics and Gynecology, Padjadjaran University Bandung.
Telephone: 0812-21039259, Email: octaviana.yoseffin@gmail.com

INTRODUCTION

Preeclampsia is defined as hypertension occurring after 20 weeks of gestation. It is characterized by systolic pressure greater than or equal to 140 mmHg, diastolic pressure greater than or equal to 90 mmHg, and proteinuria found in qualitative examination. The incidence of preeclampsia ranges between 5-10% of all pregnancies. Mortality in cases of preeclampsia and eclampsia is very high, increases with severity of the disease and the complications it causes. The incidence of preeclampsia in Indonesia is about 3.4 to 8.5% of all pregnancies. Maternal mortality rates associated with preeclampsia/eclampsia is 9.8 to 25%.¹

Most pregnant women with complications of hypertension came to the hospital in a latter stage as severe preeclampsia or eclampsia, so mitigation is not satisfactory. Early management of this disease will give better results. Prevention is the best thing, but this is not always applicable. It is because its etiology and pathogenesis haven't been known with certainty.

Periodontitis is an inflammation of the tissues supporting the teeth (periodontal tissue or periodontium).²⁻⁴ Diagnosis of periodontitis is established when there are more than three different teeth with loss of clinical attachment level (Clinical Attachment Level/CAL) ≥ 3 mm. The degree of periodontitis is⁵ divided into three, namely: Mild periodontitis: there are pock-

ets of gum with CAL ≥ 3 mm in three sites at least three different teeth, but less than 3 teeth with CAL ≥ 5 mm.

Moderate periodontitis: there are pockets of gum with CAL ≥ 5 mm in three sites at least three different teeth, but less than 3 teeth with CAL ≥ 7 mm. Severe periodontitis: there are pockets of gum with CAL ≥ 7 mm on three sites in at least three different teeth.

Offenbacher et al stated that women with periodontitis were seven times easier to experience preeclampsia.⁶ Results from researches by Lopez et al and Jeffcoat et al also found the same thing, even adding that periodontal treatment during pregnancy could reduce the incidence of preeclampsia.^{7,8}

Low birth weight baby is defined as babies born weighing less than 2,500 grams. Various factors have been associated with low birth weight babies. The main factor among all of these factors is infection. Offenbacher and his colleagues stated that periodontal disease derived from the mother could provide a response seven times greater in infants of could.⁶

Risk factors for infections are preventable and can be intervened, so hopefully if they are indeed prevented, the incidence of preeclampsia and low babies birth weight. However, a lot of incidents of infection are not known because they are subclinical and asymptomatic, such as chronic periodontitis. It is able to trigger inflammation in the placenta causing damage to it periodontitis in pregnancy can be treated so that the expected incidence of preeclampsia and low birth weight babies can be decreased.

METHOD

Study sample was a part of population who met the inclusion criteria and did not have the exclusion criteria, came to Dr. Hasan Sadikin Hospital, Bandung and its network hospitals. Research was carried out as an analytic observational study with case-control approach.

Sample size was determined using a formula to test a hypothesis with two proportions and generating the need of 26 samples for each study group. Records include the identity and characteristics of patients, which were age, parity, gestational age, diagnosis and babies birth weight. Periodontitis status examination was performed by two people who had done inter-examiner reproducibility procedure. Examination and determination of a diagnosis carried out covertly.

Clinical Attachment Level Examination/CAL was carried out by measuring the distance from the cemento-enamel Junction (CEJ) to the bottom of gum pocket with a periodontal probe and was done through two stages of measurement: the first measurement was the depth of gum pockets was measured from the gingival edge to the bottom of the gum pockets. The second was the distance from CEJ to the gingival edge. CAL value was obtained from the first measurement minus the second one. Measurements were recorded at the nearest millimeter and included six surfaces of each tooth, namely: distobuccal, buccal, mesiobuccal, distolingual, lingual and mesiolingual. In this study the authors used Ramfjord teeth to check the status of periodontitis.

Statistical analysis was used to examine the relationship between periodontitis and preeclampsia, which was using chi square or Fisher's exact test if expectative values < 5 . For multivariable analysis we used multiple logistic regression analysis. To calculate the magnitude of the risk of preeclampsia than the degree of severity of periodontitis and infant birth weight was calculated magnitude of the odds ratio and 95% confidence intervals. To calculate the correlation between the degree of severity of periodontitis and infant birth weight, we used Rank-Spearman correlation test. Significant results are determined based on the value of $p < 0$.

RESULT

The research was conducted from December 2010 to February 2011.

Table 1. Study subject characteristics.

Characteristic	Study group		p
	preeclampsia (n=26)	control (n=26)	
Age (years)			
< 20	3	2	0.381
20 - 24	2	7	
25 - 29	3	4	
30 - 34	8	7	
35 - 39	10	6	
Parity			
1 - 3	22	21	0.714
> 3	4	5	
Gestation weeks			
20 - 28	1	1	0.592
29 - 36	7	4	
≥ 37	18	21	

Table 1 shows comparison of characteristics between the two study groups. The mean age in the preeclamptic group was 32.62 and in the control group was 29.77 ($X^2 = 4.19$, $p = 0.381$). This suggests that between the two study groups there was no significant difference. Similar interpretation can be drawn from the parity characteristics of two research groups. Most of the parity in the preeclamptic group was between 1 and 3, or 84.62% compared to 80.77% of the control group ($X^2 = 0.13$, $p = 0.714$), meaning that the number of parity between the two study groups did not show significant differences. Based on gestational age, most subjects in the two groups are at term, which was 69.23% in the preeclamptic group and 80.77% in the control group. However, this does not indicate a significant difference ($p = 0.592$). Thus, both study groups are homogenous and able to be compared.

Table 2. Relationship between chronic periodontitis and pre-eclampsia.

Characteristic	preeclampsia		control		p
	N	%	N	%	
Incidence Periodontitis					
• Positive	19	73.08	12	46.15	0.048
• Negative	7	26.92	14	53.85	
Grade Periodontitis					
• Periodontitis (-)	7	26.92	14	53.85	0.045
• Mild periodontitis	8	30.77	9	34.61	
• Moderate periodontitis	3	11.54	2	7.69	
• Severe periodontitis	8	30.77	1	3.85	

Table 2 shows a difference in the incidence of periodontitis between the preeclamptic group and control group. From the table, it can be seen that in the preeclamptic group there were 73.08% cases of periodontitis. Whereas in the control group, there was a lower incidence of periodontitis, which was 46.15% ($p = 0.048$; OR 3.17, 95% CI: 1.19 to 8.41) which means that in this study the risk for preeclampsia to occur in patients with periodontitis is 3.17 times the risk of patients without it.

Table 3. Correlation between severity of periodontitis with babies birth weight.

Characteristic	BW < 2500 gram		BW ≥ 2500 gram		p
	N	%	N	%	
Periodontitis (-)	6	27.27	15	50.00	<0.001
Mild periodontitis	3	13.64	14	46.67	
To severe periodontitis	13	59.09	1	3.33	

Table 3 above shows the relationship between severity of periodontitis with babies birth weight. Incidence of moderate-severe periodontitis was more prevalent in groups of babies birth weight < 2500 grams, which is about 59.09%, while in the group of birth weight ≥ 2500 grams there was hardly an incidence of periodontitis ($p < 0.001$). This shows that there is a significant association between severity of periodontitis with babies birth weight.

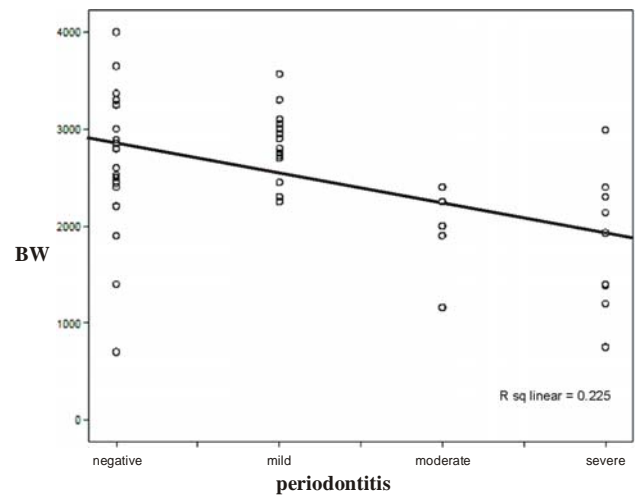


Figure 1. Correlation between periodontitis and babies birth weight.

Figure 1 illustrates the correlation between periodontitis with babies birth weight. Based on Rank-Spearman correlation test we obtained an r_s of - 0.423 with a p -value of 0.002. This suggests that there was a significant negative correlation between the degree of periodontitis with babies birth weight, or in other words, the more severe periodontitis, the lower the babies birth weight.

DISCUSSION

In a previous study conducted by Boggess et al, incidence of periodontitis in pregnancy was reported to be associated with an increased risk of preeclampsia.⁹ This is consistent with the findings in this study. Based on Table 2, we can see that there is a significant difference between the incidence of periodontitis among the group of subjects with preeclampsia and control groups ($p = 0.048$, $p < 0.05$), with an odds ratio value of 3.17 (95% CI 1.19 to 8.41). This value means that the incidence of periodontitis is 3.17 times higher in patients with preeclampsia compared to subjects without it. Contreras reported that patients in the preeclamptic group had a worse periodontal health than normotensive patients. Periodontal disease was found in 46.3% patients with preeclampsia and 21.9% of normotensive patients.¹⁰ The result of this study support the hypothesis that the incidence of periodontitis is more prevalent in pre-eclampsia than normal deliveries.

Ethiology and pathogenesis of preeclampsia are still controversial. Despite known abnormal placentation and inadequate perfusion, these changes are not sufficient to explain the occurrence of hypertension and proteinuria existing in preeclampsia. Theoretically, other possible factors included the existence of immunological intolerance between maternal and fetal placental tissue, maternal maladaptation inflammatory changes in normal pregnancy, nutritional deficiencies, and genetic influences. This may explain the incidence of preeclampsia in a subject who does not suffer from periodontitis, which can be seen in Table 2.

Normal pregnancy is characterized by the presence of mild inflammation state and reduced cellular im-

munity, so periodontitis during pregnancy may further aggravate these circumstances. Infection can be a trigger to initiate an inflammatory response and the occurrence of preeclampsia with a formation of proinflammatory cytokines, causing a state of oxidative stress early in pregnancy, increasing free radicals and including endothelial damage.

This is a possible explanation for the occurrence of preeclampsia in chronic periodontitis and the increased severity of periodontal disease in patients with preeclampsia. This explanation is in line with a research done by Canacki et al, which states that there is a relationship between the number of tooth surfaces damaged and the incident preeclampsia.¹¹ Similarly, Offenbacher states that the severity of periodontal disease would further increase the degree of severity preeclampsia.¹² Both research are in accordance with the results of this study, which can be seen in Table 2. In this table, there is an increase of chronic periodontitis odds ratio with every degree of preeclampsia. There is a 16 fold risk for the occurrence of preeclampsia in severe chronic periodontitis.

Data obtained in this study that describes the correlation between the degree of severity of periodontitis with babies birth weight are presented in Table 3 and Table 1. At the table, it can be seen that there is a very significant relationship between severity of periodontitis with babies birth weight ($p < 0.001$). From Rank-Spearman correlation test values was obtained $r_s = -0.423$ ($p = 0.002$). the graph 4.1 illustrates a significant negative correlation between the degree of periodontitis with babies birth weight. This means that the more severe the degree of periodontitis, the lower the babies birth weight.

The results are consistent with a previous research conducted by Khader et al who stated that the degree of severity of periodontitis was associated with an increased odds ratio for babies birth weight.¹³ Previous studies that support this is a research conducted by Marin et al who stated that there were weight loss babies born in periodontitis patients.¹⁴ Sixou and Vergnes in another meta-analysis study reported that there was an increased odds ratio of 2.83 decrease in babies birth weight in mothers who suffer periodontitis.¹⁵

The same thing occur in the findings obtained by Offenbacher et al. In that study, Offenbacher found a significant increase in PGE₂ levels in gingival crevicular fluid in mothers who gave birth to babies with low birth weight. They also found a significant inverse relationship between birth weight and elevated PGE₂.⁴ A possible explanation for his outcome is that the molecules produced in the periodontium can enter the maternal circulation, reach the placenta, and increase levels of TNF- α in amniotic fluid to get to the fetus.

The results are consistent with a research conducted by Cota et al who stated that women who suffer from periodontitis have twice the risk for the occurrence of stunted fetal growth (OR = 2.06, 95% CI: 1.07 to 4.19, $p < 0.001$).¹⁶ The same results can be found in researches done by Dasanayake (OR = 4.1), Lunar-delli and Peres (OR = 2.0), and Marin et al (OR = 1.9).^{14,17,18}

Bretelle et al reported that placental endothelial changes due to inflammatory processes could lead to poor perfusion of nutrients to the fetus. Thus, stunted fetal growth could occur, because the placental vascular endothelium was the key that connected the fetus with placenta.¹⁹

The frequency of birth weight < 2500 grams in this study was 42.31%, standing against results obtained by Fang (8.6%), Williams et al (11%), and Mitchell-Lewis et al (16.5%).²⁰⁻²² Birth weight is influenced by geographical conditions, socio-economic status, race, and access to health services nearby. Hospital where this research was conducted referral hospital and subjects came from middle or lower socioeconomic group. This may explain the high frequency of birth weight < 2500 grams of the study subjects. Limitations of this study is that the research is still not able to distinguish the cause of birth weight less than 2500 grams whether it is purely due to periodontitis or preeclampsia or because of the less than 37 weeks-gestational age, which is known as a factor that also affect the birth weight infants. Thus, further studies are still needed.

CONCLUSION

There are differences in the incidence of chronic periodontitis in preeclampsia and without preeclampsia. Incidence of chronic periodontitis are more common in preeclampsia than without preeclampsia. The more severe the degree of periodontitis, the lower the babies birth weight.

Subjects with chronic periodontitis have a 3.17 times the risk to have preeclampsia. Subjects with severe periodontitis have 16 times the risk to have preeclampsia. Subjects with moderate and severe periodontitis had have 32.5 times the risk to get a baby with a birth weight < 2500 grams.

Dental examinations should be added as a routine examination for pregnant women in to reduce the risk of preeclampsia and the incidence of low birth weight babies.

REFERENCES

1. Saifudin AB. Buku acuan nasional pelayanan kesehatan maternal dan neonatal. Edisi ke-2. Jakarta: Yayasan Bina Pustaka Sarwono Prawirohardjo; 2000
2. Rustveld LO, Kelsey SF, Sharma R. Association between maternal infections and preeclampsia: a systematic review of epidemiologic studies. *Matern Child Health J.* 2008; 12: 223-42
3. Rai B, Kharb S, Anand SC. Oral and maxillofacial surgery and orthodontic: Is periodontal disease risk factor for onset of preeclampsia and fetal outcome? *Adv. in med dent. Sci.* 2008; 2(1): 16-9
4. Barak OO, Vettore MV, Lamarca GA, Thomaz FB, Sheiham A, Leal MC. Severe pregnancy complication (preeclampsia) is associated with greater periodontal destruction. *J Periodontol.* 2005; 76: 134-7
5. Bassani DG, Kreiger N. Periodontal disease and perinatal outcome: a case control study. *J Clin Periodontol* 2007; 34: 31-9
6. Offenbacher S, Boggess KA, Lieff S, Murtha AP, Moss K, Beck J. Maternal periodontal disease, systemic inflammation, and risk for preeclampsia. *Am J Obstet Gynecol.* 2008; 198: 389-95

7. Lopez C, Canacki V, Michalowicz BS, Hodges JS, DiAngelis AJ, Lupo VR, Novak MJ. Periodontal disease increase the risk of severe pre-eclampsia among pregnant women. *J Clin Periodontol*. 2007; 34: 639-45
8. Jeffcoat M, Cota LOM, Guimarães AN, Costa JE, Lorentz TC, Costa FO. Association between maternal periodontitis and an increased risk of preeclampsia. *J Periodontol*. 2006; 77(12): 2063-9
9. Boggess KA. Pathogenicity of periodontal pathogens during pregnancy. *Am J Obstet Gynecol*. 2005;193:311-2.
10. Contreras A, Sander M, Cassolato S, Chen A. Periodontitis is associated with preeclampsia in pregnant women. *J Periodontol*. 2006; 77: 182-8
11. Canacki V, Madianos PN, Bobetsis YA, Barros SP. Periodontal disease as a risk factor for preeclampsia: a case control study. *Aus, New Zealand J Obstet Gynecol*. 2004; 44: 568-73
12. Khader YS, Ta'ani Q. Periodontal disease and the risk of preterm birth and low birth weight: a meta-analysis. *J Periodontol*, 76: 161-5
13. Offenbacher S, Xiong X, Buekens P, Fraser WD, Beck J. Periodontal disease and adverse pregnancy outcomes: a systematic review. *BJOG*. 2006; 113: 135-43
14. Marin C, Segura-Egea JJ, Martinez-Sahuquillo A, Bullon P. Correlation between infant birth weight and mother's periodontal status. *J Periodontol* 2005; 76: 2144-53
15. Sixou M, Vergnes JN. Preterm low birth weight and maternal periodontal status: a meta-analysis. *Am J Obstet Gynecol*. 2007; 196: 135-7
16. Cota LOM, Guimarães AN, Costa JE, Lorentz TCM, Costa FO. Association between maternal periodontitis and increased risk of preeclampsia. *J Periodontol*. 2006; 77: 2063-9
17. Dasanayake AP. Poor periodontal health of the pregnant woman as a risk factor for low birth weight. *Ann Periodontol*. 1998; 3(1): 206-12
18. Lunardelli AN, Peres MA. Is there an association between periodontal disease, prematurity and low birth weight? A population-based study. *J Clin Periodontol* 2005; 32: 938-46
19. Brutelle F, Sabatier f, Shojai R. New insight in physiopathology of preeclampsia and intrauterine growth retardation: Role of Inflammation. *Gynecol Obstet Fertil* 2004; 32: 482-9
20. Fang S. Management of preterm infants with intrauterine growth restriction. *Early Hum Dev* 2005; 81: 889-900
21. Williams CE, Davenport ES, Sterne JAC, Sivapathasudaram V, Fearne JM, Curtis MA. Mechanism of risk in preterm low birth weight infants. *J Periodontol* 2000; 23: 142-50
22. Mitchell-Lewis D, Engebretson SP, Chen J, Lamster IB, Papapanou PN. Periodontal infections and preterm birth: Early findings from a cohort of young minority women in New York. *Eur J Oral Sci* 2001; 109: 34-9